AQUARIUS

Education & Public Outreach

Evaporation Investigation

Unit: *Salinity Patterns & the Water Cycle* **I Grade Level:** *Elementary* **I Time Required: Activity 1 -** *One 20 min. period, then 10 min. follow-up observations, one 30 minute wrap-up period* **Activity 2** *– two 30 minute periods* **I Content Standard:** *NSES Physical Science, properties of objects and materials* **I** ***Ocean Literacy Principle 1f:*** *The ocean is an integral part of the water cycle and is connected to all of the earth's water reservoirs via evaporation and precipitation.*

Big Idea:
Water can "disappear" or evaporate into the air.

Key Concepts:
- Evaporation occurs when a liquid is changed into a gas.
- The rate of evaporation increases when the temperature of a liquid is increased.
- Water moves around our planet in the water cycle.

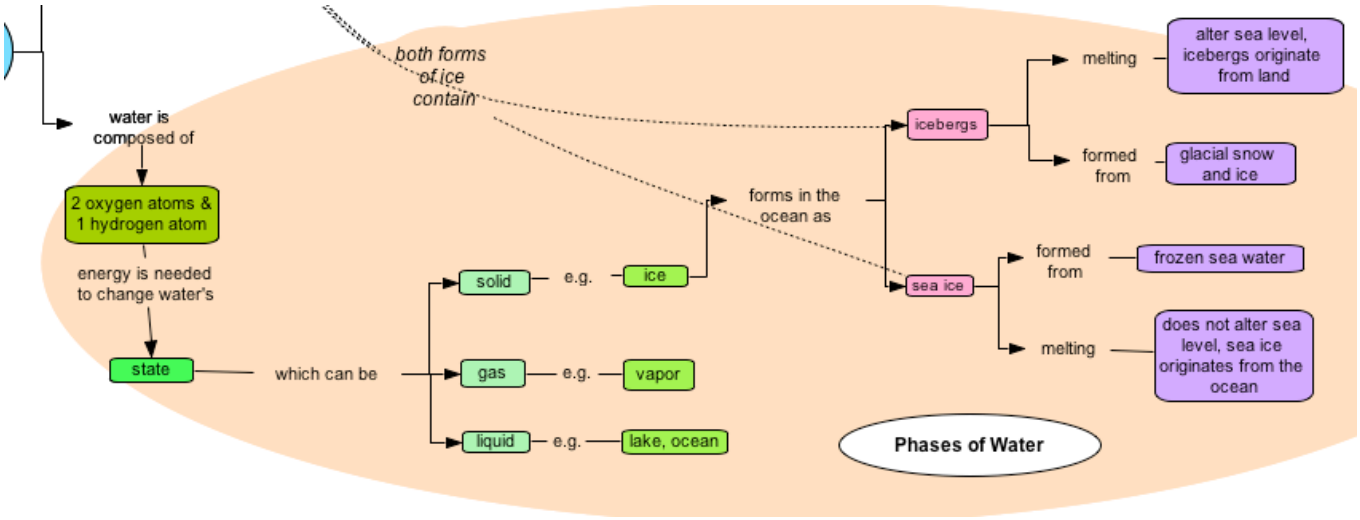
Essential Questions:
- How does water change?
- How does water move?
- How does life depend on water?
- Where does the water go when it is evaporated?

Knowledge and Skills:
- Observe the process of evaporation or "the disappearance of wetness into the air".
- Compare and contrast their observations made before and after the evaporation.
- Construct a diagram of the experiment and use it to explain the results.
- Describe the process of evaporation through discussion and pictures.

Prior Knowledge:
- Some events in nature have a repeating pattern—such as daily weather patterns or changes in temperature and the appearance of rain and snow at different times of the year.
- Water can be a liquid, solid, or gas and can go back and forth from one form to the other.

Common Preconceptions:
- At the lower elementary grades, evaporation and condensation will mean nothing different from disappearance and appearance.
- Students have a difficult time accepting the idea of invisible particles of water in the air.
- Students understand the concept of boiling and freezing well before understanding evaporation and condensation.
- When water evaporates, it just disappears and ceases to exist.
- When water evaporates, it immediately goes up to the clouds or into the sun.

Concept Map- Primarily for the teacher's use, the map provided here relates to the branch "Phases of Water" from the comprehensive Aquarius Concept Map – *Water & its patterns on Earth's surface*.



Background

Evaporation is the process by which water changes from a liquid to a gas or vapor. Evaporation is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapor. Studies have shown that the oceans, seas, lakes, and rivers provide nearly 90 percent of the moisture in the atmosphere via evaporation, with the remaining 10 percent being contributed by plant transpiration.

Evaporation from the oceans is the primary mechanism supporting the surface-to-atmosphere portion of the water cycle. After all, the large surface area of the oceans (over 70 percent of the Earth's surface is covered by the oceans) provides the opportunity for large-scale evaporation to occur. On a global scale, the amount of water evaporating is about the same as the amount of water delivered to the Earth as precipitation. This does vary geographically, though. Evaporation is more prevalent over the oceans than precipitation, while over the land, precipitation routinely exceeds evaporation. Most of the water that evaporates from the oceans falls back into the oceans as precipitation. Only about 10 percent of the water evaporated from the oceans is transported over land and falls as precipitation. Once evaporated, a water molecule spends about 10 days in the air. The process of evaporation is so great that without precipitation runoff, and ground-water discharge from aquifers, oceans would become nearly empty.

Less evaporation takes place during periods of calm winds than during windy times. When the air is calm, evaporated water tends to stay close to the water body. When winds are present, the more moist air close to the water body is moved away and replaced by drier air which favors additional evaporation.

From the US Geological Survey Water website
http://ga.water.usgs.gov/edu/watercycleevaporation.html

Materials:

Activity 1 – *containers with lids (a coffee can works well), water; wooden stirring sticks (paint stirrers); markers; colored sticky dots; measuring cups*

Activity 2 - *Salt; warm water (aids dissolving of the salt); paper; paint brushes; food coloring; measuring cups; containers (plastic cups work well and can be reused); spoons for mixing*

Preparation:

Break students into working pairs for both activities. For **Activity 2,** pre-measure a ¼ cup of salt into containers for each student pair. Depending on how many colors you want each group to have you'll have to calculate how many containers and how much salt you'll need.

Activity – 1

Adapted from "Disappearing Water" – Science NetLinks
http://www.sciencenetlinks.com/about.htm

- Show students a coffee can filled halfway with water. Provide the following instructions to the

students: *"Each group will receive two coffee cans that will each be filled with the same amount of water. You will cover one of the cans and leave the other one open. Over the next few days you'll watch the cans to find out what happens to the water over time. Your job is to keep a journal that shows the results of what you see happening in each can. We will discuss what happens at the end of our study."*

- Each student pair should label their cans with their names. Mark each can with a colored dot.
- Show the students the wooden splints. Ask students how the splints could be used to test what happens to the water level over time.
- Each group/pair should use their measuring cup to fill each can with the same amount of water.
- Have students measure the water levels by dipping their splints into water at the side of the can until it touches the bottom. They should make a thin line on their splint at the water level. Mark the splints with another colored dot that matches the coffee can colored dot where the measurement was taken.
- Place the can in a safe area and instruct the students to cover one of the cans. Explain again to the students that one can will remain covered for the tests.
- Students should check the cans on a regular basis (daily or every other day) and record observations in their journal. They should use markers to mark the water levels on their splints. Based on their sticks, the students should draw an illustration in their journal, that shows what is happening to the water in the cans over time.
- Extension: Have each group glue its marked sticks to a piece of construction paper. After the sticks have been glued, students should label each of the lines for the days of measurements taken. The students should use this to help them answer and understand the following questions in the Assessment section.

Activity - 2: *Adapted from The Educator's Reference Desk (J. Van Loy)* http://www.eduref.org/

- The students will paint with saltwater paints and witness evaporation taking special notice that only the water evaporates and the colored salt is left behind.
- In advance of painting, discuss weather and the water cycle. Use a diagram of the water cycle to facilitate the discussion. Explain how energy (from the sun) warms the water in bodies of water like the oceans and lakes and the water evaporates into the air. The water vapor in the air condenses into clouds. The clouds become filled with water and falls as rain back into the oceans and on the land.
- Provide the saltwater painting materials to each group. Instruct them to pour the salt into the warm water and gently stir until the salt has dissolved. The teacher will come around to each group with the food coloring and help the students add it to their saltwater mixtures. This also allows the students to choose the colors.
- Ask the students to paint scenes that are related to the water cycle using the colored, saltwater mixtures.
- Lay the paintings to dry overnight.

Assessment Activity 1:

- Using a white or chalk board to record the group's answers ask the following questions:
  - What happened to the level of the water in the closed can?
  - What happened to the level of the water in the open can?
  - Is there a difference in what we saw happen between the two cans? What is the difference?
  - What did we do that was different with the cans
  - What if we used jars instead of cans? Do you think our result would be different? Why or why not?
- Have students draw the results of what happened to the water in the cans. Tell them to be prepared to share and describe their drawings.
- Have students share their pictures and describe the results that they saw for each of the studies. In both cases of the open can, what happened to the water in it? What happened to the water in the closed can? If you had a glass of water that you wanted to save, should you leave it opened or closed? Why?
- Ask students to write/share a brief response to the following scenario. *"It rained last night. You*

notice a puddle in your yard the next morning and splash in it for a little while. Your mom tells you to come inside and get ready to go to the beach, because it is a beautiful sunny day. When you return in the afternoon to play in the puddle it has changed. What do you think will have happened to it? Draw a picture that illustrates what has happened.".

Assessment Activity 2:

- The following day, students will examine their paintings to find that the water has evaporated but the colored salt remains.
- After a group discussion about evaporation, have the students write a brief summary of what happened with their painting. Ask each student to explain how the process of evaporation relates to the scene depicted in his or her painting.
- OPTIONAL: If the range of scenes illustrated by the group includes rain, snow, clouds, a lake or ocean, then conduct a gallery walk of the student's artwork. As a group, categorize each of the paintings by which part(s) of the water cycle they depict (i.e., precipitation, evaporation, or both).

Wrap Up: Re-engage the essential questions in a class discussion.

Vocabulary

- **evaporation**: the changing of water from a liquid to a gas
- **precipitation**: the process by which water molecules condense to form drops heavy enough to fall to the earth's surface